UNIT III

HOW TO PERFORM RCM

Module 4

HARD TIME TASK

HARD TIME TASK

Topics:

Introduction

- **Introduction**
- **Task Development**
- **Review and summary**

HARD TIME TASK

Module Objective:

Introduction

This module will provide information for evaluating and developing Hard Time tasks.

1. Identify when a Hard Time task is appropriate

2. Show how to develop a Hard Time task for a given failure mode.

3. Show how to determine an appropriate task interval for a Hard Time task.

HARD TIME TASK

TASK DEVELOPMENT

HARD TIME TASK

Definition:

Task Development

Hard Time Task - The scheduled removal of an item or a restorative action at a specified age/usage limit to prevent functional failure.

HARD TIME TASK

Questions:

Task Development

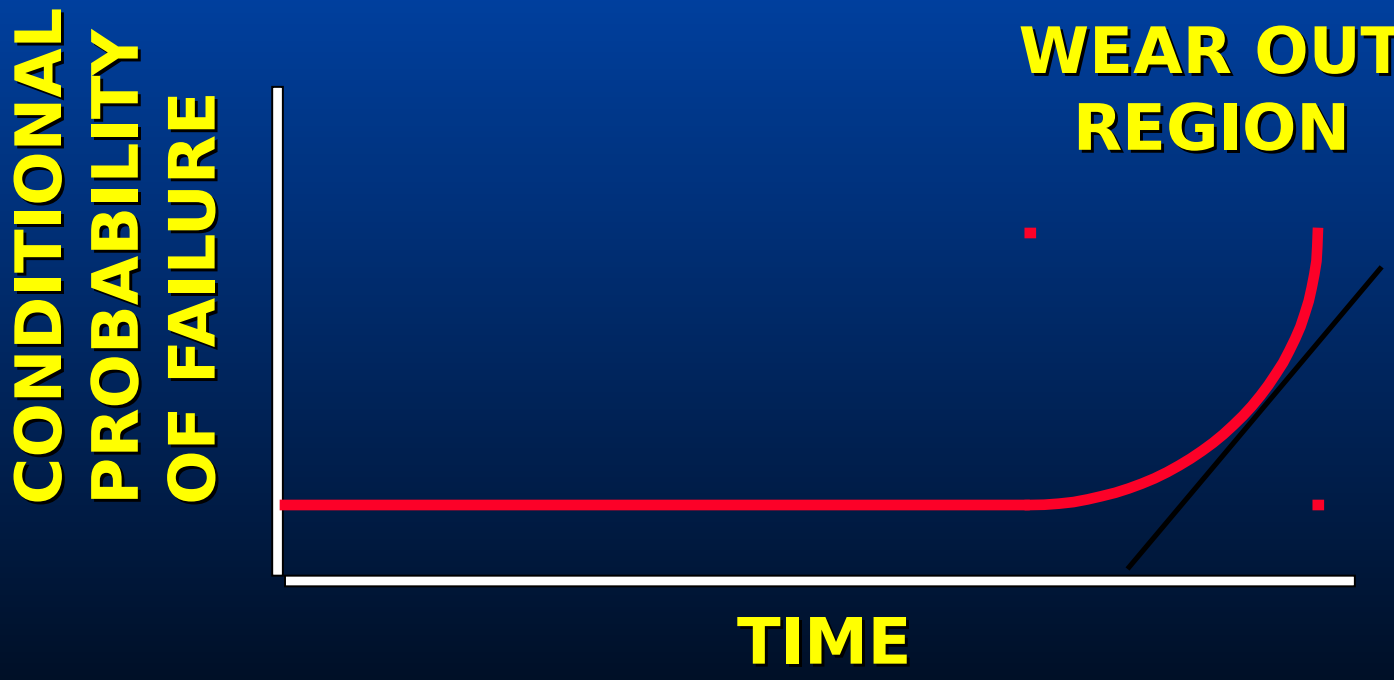
- **Does the item have a time or usage related wear-out age?**
- **Do an acceptable percentage of items survive to the wear out age?**
- **Can a task be developed that reduces the probability of failure to an acceptable level?**
- **Is the task and required interval practical?**

HARD TIME TASK

Wear Out:

Task Development

- **Described as increase in conditional probability of failure with age**



Slope Of Curve Determines Wear Out

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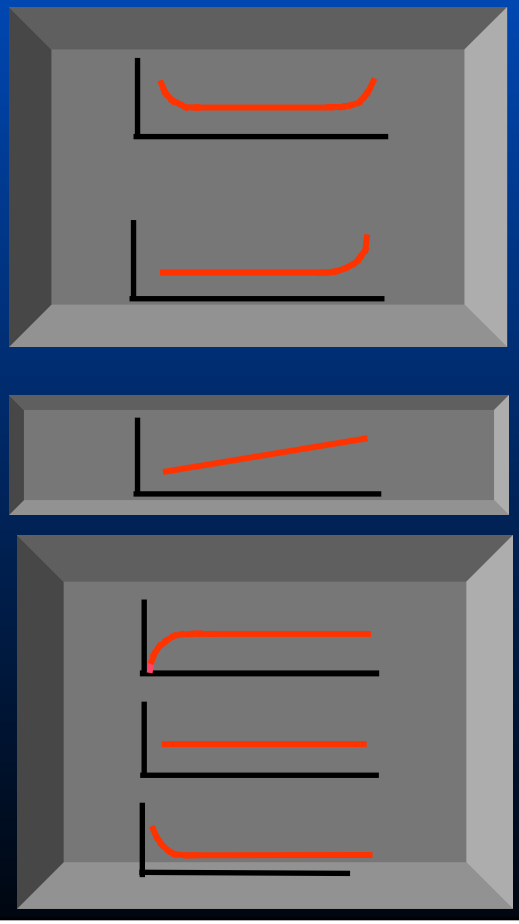
Wear Out:

Task Development

Not all items wear out

- **Some items show well defined wear out age where rapid increase in probability of failure occurs**
- **Other items may show steadily increasing conditional probability of failure that may support a hard time limit.**
- **Other items may not show wear out at all**



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Survival to Wear Out Age: **Task Development**

- **Task intervals for items exhibiting age related wear out characteristics typically stated in terms of Life Limits**
  - **Safe Life Limit**
  - **Economic Life**

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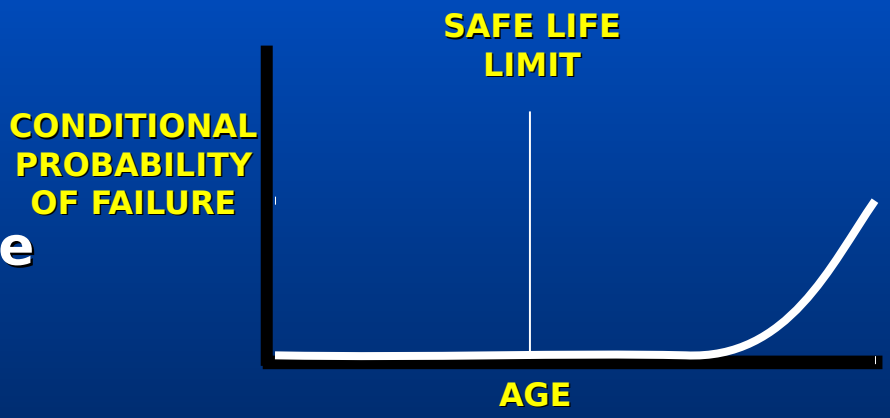
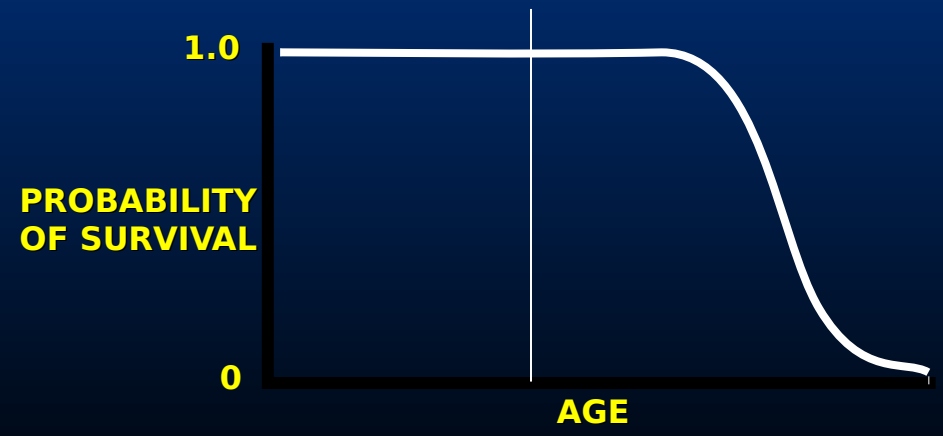
Survival to Wear Out Age: Task Development

Safe life limits

- Imposed only on items whose failure modes have safety consequences
- Item must survive:
  - to age below which no failures are expected to occur **or,**
  - where probability of survival meets program criteria





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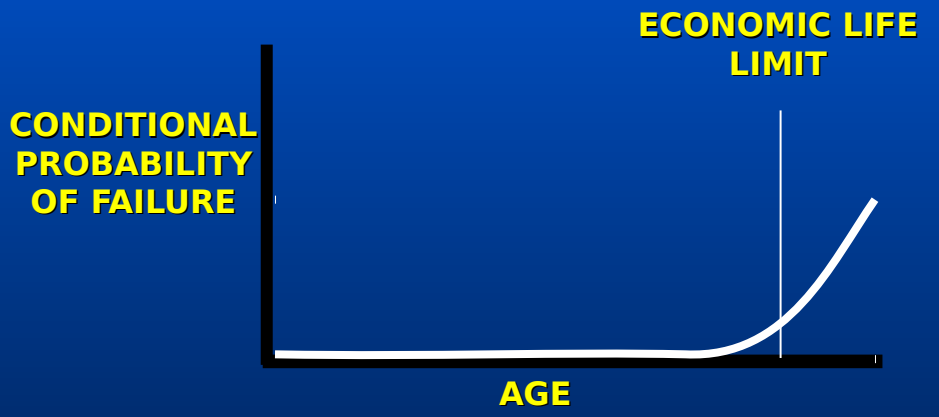
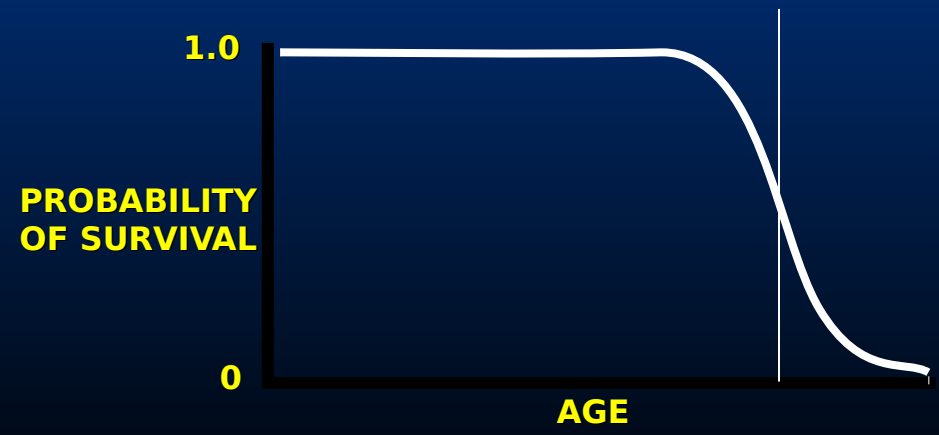
Survival to Wear Out Age: Task Development

Economic Life

- Used for items whose failure modes have only **Economic/Operational Consequences**
- Warranted for item if it is **cost effective** to remove before it fails
- **Set** to maximize item's useful life/minimize overall cost





HARD TIME TASK

Task Interval:

Task Development

- Based on **age to wear out**
- For task **to be effective**:
  - Safety: Task Interval must **reduce probability of failure to acceptable level**

$$P_{act} \leq P_{acc}$$

  - Non-safety: Task interval must **produce a cost effective task**

HARD TIME TASK

Task Interval:

Task Development

Methods typically used to determine wear out ages and task intervals:

Failures with Safety Consequences:

- **Statistical analyses (e.g., Weibull analysis)**
- **Fatigue or other testing to failure**
- **Fatigue analysis**

Failures with Non-Safety Consequences:

- **Above plus Economic trade-off analysis**

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Weibull Analysis:

Task Development

Statistical technique using failure data to calculate accurate failure predictions

How it is used:

- **Plot failure data**
- **Determine various parameters that describe the failure data**
- **Use the parameters to determine if a hard time task is appropriate and at what interval it should be done**

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Fatigue Testing:

Task Development

Used to determine wear out age or safe life limits for components that must operate without failure for a certain amount of time

How it is used:

- **One or more components are tested to failure**
- ***Estimate* of earliest failure of one item in population is made.**
- **May be combined with Weibull or other statistical analysis or used with established safety factor**

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Fatigue Analysis: **Task Development**

Used to determine wear out age or safe life limits for components that must operate without failure for a certain amount of time

How it is used:

- **Mathematical analysis is conducted to determine *Life to crack initiation and growth to critical crack size***
- **The calculated *life to crack initiation* is typically divided by a safety factor to obtain the hard time task interval for primary structure**
- **Some less critical applications may also include part of the crack-growth life in the Hard time interval**

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Economic Trade-off Analysis: Task Development

Conducted when working with non-safety related failure modes

- **Method compares cost of the hard time task to the cost of allowing a failure to occur**
- **Analytical methods provided in Appendix C of NAVAIR 00-25-403**
- **Again… Correct application of numerical methods is the responsibility or each analyst/RCM team**

HARD TIME TASK

Estimating Methods:

Task Development

Methods for estimating task interval when exact data is not available:

- **Use manufacturer's recommended service life**
- **Base new task on an existing effective maintenance task**
- **Use engineering judgement based on similar components in similar applications**

Age exploration should be used to refine default intervals

Use safety factor or statistical methods for failure modes with safety consequences

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Considerations:

Task Development

- **Ensure consideration of induced infant mortality failures from rework or overhaul tasks**
- **Ensure rework or overhaul tasks returns item to original condition or a reduced interval may be required after overhaul or rework**

HARD TIME TASK

Module Objective **Review and Summary**

- Provide information for evaluating and developing a Hard Time task.

Introduction

- Learning Objectives

Task Development

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- Wear Out
- Survival to Wear Out Age
- Task Interval
  - Weibull Analysis
  - Testing
  - Fatigue Analysis
- Default Methods

End of Module

up next.....

Failure Finding Task